JAPAN

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JIS T 8134 (2007) (English): Protective helmets for bicycle users

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The citizens of a nation must honor the laws of the land.

Fukuzawa Yukichi

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Protective helmets for bicycle users

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Contents

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Safety Appliance Association (JSAA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS T 8134** : 1995 is replaced with this Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

Protective helmets for bicycle users

1 Scope

This Japanese Industrial Standard specifies the protective helmets for bicycle users (hereafter referred to as "protective helmets"), which is put on when riding on a bicycle, for the purpose of protecting the users and infants riding together from the injury on their heads and mitigating the degree of injury.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS D 1050 *Road vehicles—Techniques of measurement in impact tests—Instrumentation*

JIS K 6253 *Rubber, vulcanized or thermoplastic—Determination of hardness*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1 protective helmet

the helmet put on the user's head for the purpose of absorbing impact energy to lessen the risk of users' head injury, which consists of at least a shell, anti-concussion liner, supporting device and wearing device

3.2 shell

a part which forms the outline of protective helmet

It includes also a portion which is not necessarily rigid shell-shaped.

3.3 anti-concussion liner

a material attached along the inside of shell for the purpose of absorbing impact energy

3.4 supporting device

a device for keeping the protective helmet in an appropriate position on the head, which consists of all parts such as a chin strap, a chin strap mounting part, a chin strap length adjusting part and a chin strap fastener

3.5 attaching device

a collective designation of parts attached to the inside of shell, other than the anti-concussion liner and the supporting device

3.6 chin cup

the accessory formed by adjusting to the form of chin of a protective helmet user

3.7 base plane of head

a horizontal plane passing through the edges of external auditory pores (external auditory canals) and orbits (eye sockets)

3.8 base plane of headform

a plane on the headform which corresponds to the base plane of head (see figure A.1)

3.9 reference plane

a plane for drawing which is parallel to the base plane of headform and is specified at a certain distance apart from the base plane according to the size of the headform (see figure A.1)

3.10 vertical centre axis

a straight line which is so specified as to pass through the centre of the anteroposterior and lateral lines of the reference plane of headform, and is perpendicular to the base plane of headform (see figure A.1)

3.11 central sagittal plane

a vertical symmetric centre plane of the head, the headform or protective helmet to be put on which passes through the vertical centre axis

3.12 guidepost for wearing the protective helmet

a vertical distance between the lower end of anterior edge and the reference plane of the protective helmet at the time of wearing the protective helmet on headform

The distance shall be specified for each size and each type of protective helmets by the manufacturer (see Annex A).

3.13 infant riding together

a preschool child riding together in an auxiliary seat of bicycle

3.14 test range

the range subject to the shock absorption test shall be a range shown in figure 1 a) and figure 1 b) depending on whether the protective helmet is applicable to an infant aged under 6 or not

4 Performance

4.1 Shock absorption

The shock absorption is the protective function for frontal region, back region, temporal region and parietal region of head. When the protective helmet is tested as specified in 7.3, the impact acceleration at the gravity centre of headforms shall be 2 940 m/s^2 (300 G) or less. In addition, in the case where the impact acceleration of not less than 1 470 m/s^2 (150 G) is generated, its duration shall be 4 ms or less.

NOTE: Numerals G in parentheses following the standard values 2 940 m/s^2 and 1 470 m/s^2 of impact acceleration represent conventionally used gravity acceleration values.

4.2 Strength of supporting device

When the supporting device is tested for the strength as specified in **7.4**, the maximum elongation shall be of 35 mm or less. In addition, the fastening device shall be easily detachable after the test.

4.3 Supporting capacity (roll off)

When tested for the supporting capacity (roll off) as specified in **7.5**, the protective helmet shall not drop down from the headform under testing.

4.4 Visual field

The visual field shall, when tested as specified in **7.6**, be 105° or over in every horizontal, upward and downward direction.

5 Construction

5.1 Construction in general

In general, the protective helmet consists of a shell, anti-concussion liner, attaching device and supporting device for protection of a wearer's head, and shall have durability sufficient to withstand normal handling. The parts of protective helmet (a visor, rivet, vent hole, size adjusting device, edge covering, fastening device, etc.) shall be so designed and manufactured as not to injure the wearer in normal use and shall satisfy the following matters.

a) The outer surface of protective helmet shall be made of such materials as to minimize friction with road surface in case of falling, and means such as chamfering shall be taken for any protrusion or any bump on the surface of protective helmet.

b) The shell made of hard materials shall not have a sharp corner on the end.

c) Protrusions on the inside surface of the shell shall have no sharp edge. The hard protrusion shall, if any, be designed so that the impact energy applied to heads does not concentrate strongly on it, by using a pad, etc.

d) The width of chin strap shall be 15 mm or over.

e) The chin cup shall not be attached with the chin strap.

f) The size-adjusting device shall not easily come off without any intent of wearers, or not move so as to cause the dimension change in use.

g) Any snap and other hard protrusion (excluding a head of rivet) fixed on the shell shall not be excluded more than 5 mm outward from the outside surface of the shell. However, a device intended to make the protective helmet easily wearable, which is readily removable, may be allowable.

h) The head of rivet on the outside surface of shell shall not be protrude more than 2 mm outward from the surface.

i) A vent hole may be provided.

5.2 Accessories

The accessories shall be as follows.

a) The protective helmet may be attached with a reflecting material, etc., by which lights such as head lights of automobiles can be easily recognized through reflecting during night.

b) The accessories shall, when attached with the protective helmet, not impair the safety.

6 Materials

The protective helmet shall be made of such materials as to be little affected by exposures to sunlight, temperature and rain, etc. in normal use. The parts of protective helmet which come in contact with the wearer's skin shall be made of such materials that their functions do not significantly deteriorate by the influence of perspiration or cosmetics.

7 Test

7.1 Headform

The headform to be used for the test shall comply with the dimensional characteristics specified in Annex B and Annex C, and the requirements showed in table 1.

Table 1 Headform

Size of protective helmet mm	Type of protective headform	Mass of headform kg	Size of headform mm	Gravity centre of headform(positioned below the reference plane) mm
Less than 540	A	3.1 ± 0.10	500 ± 5	11.1
540 or over to and excluding 570	E	4.1 ± 0.12	540 ± 5	11.9
570 or over to and excluding 600	J	4.7 ± 0.14	570 ± 5	12.7
600 or over to and excluding 620	M	5.6 ± 0.16	600 ± 5	13.3
620 or over	O	6.1 ± 0.18	620 ± 5	13.7

NOTE 1 The headform to be used for the shock absorption test shall be made of low echoic magnesium alloy.

NOTE 2 The specification of headform mass shall apply only to the headform to be used for shock absorption test.

NOTE 3 The mass of headform includes mass of an accelerometer, ball socket and supporting arm.

NOTE 4 A cutout may be provided to avoid interference with the support arm when a wire-guided drop device is used.

NOTE 5 The gravity centre of headform (including the support arm when the wire-guided drop device is used) shall be at the position indicated in table 1 on the vertical central axis, and the accelerometer shall be mounted at the position of gravity centre.

7.2 Pre-conditioning

7.2.1 Method of conditioning

Each pre-conditioning of a sample under test shall be as follows.

a) **Conditioning at room temperatures** Place the protective helmet under the condition of 23 °C ± 5 °C in temperature for 4 h or over.

b) **Conditioning at high temperatures** Place the protective helmet under the condition of 50 °C ± 2 °C in temperature for 4 h to 24 h.

c) **Conditioning at low temperatures** Place the protective helmet under the condition of − 10 °C ± 2 °C in temperature for 4 h to 24 h.

d) **Conditioning by immersion** Immerse the protective helmet in water at 25 °C ± 5 °C for 4 h to 24 h.

7.2.2 Test after pre-conditioning

The tests after each pre-conditioning shall be as follows.

a) **Tests after high temperature and low temperature pre-conditionings** Tests after high temperature and low temperature pre-conditionings shall generally start at room temperature within 2 min after the sample has been taken out from the pre-conditioning bath and finish within 5 min. If 5 min or over elapses after it has been taken out, every pre-conditioning shall be repeated for the sample at a rate of 3 min per minute of overtime, and then the test shall be carried out.

b) **Tests after immersion conditioning** Test after pre-conditioning by immersion shall be carried out within 6 h after a lapse of at least 15 min since the sample has been taken out from the pre-conditioning apparatus, in consideration of a draining period.

7.3 Shock absorption test

7.3.1 Test method

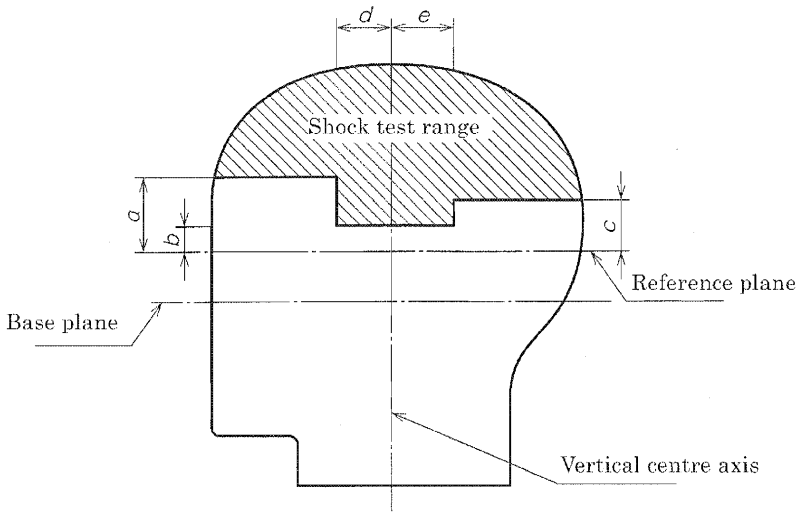
For the shock absorption test, use the headform selected as shown in table 1 corresponding to the maximum size of the protective helmet (the maximally adjusted size for size-adjustable protective helmets), and carry out the test for each pre-conditioned sample as specified in **7.2.1 b)** to **d)**.

7.3.2 Range of test (Range of striking points)

The test range shall be as follows.

a) When the protective helmet is put on the headform as specified in Annex A, the striking points shall be within the test range shown in figure 1 a) or figure 1 b) corresponding to the range of user's age of the protective helmet.

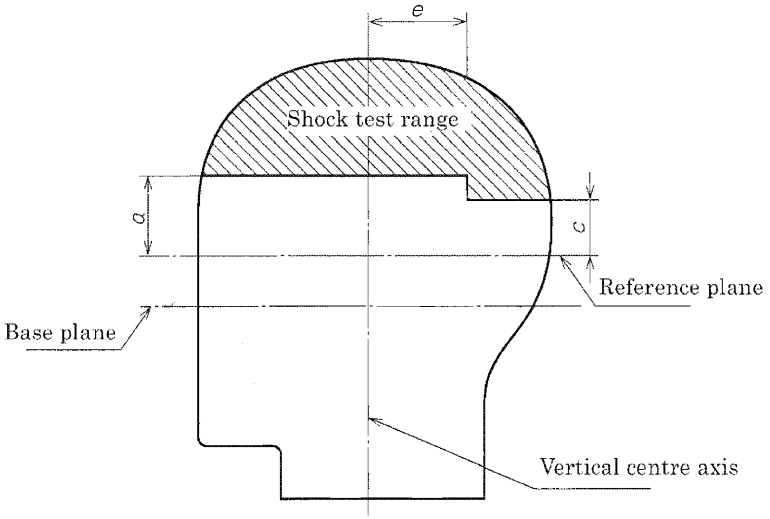
In addition, the striking points shall be four optional points within the test range apart from each other with 1/5 or over of the maximum circumference of the protective helmet.



Unit : mm

Type of headform	*a*	*b*	*c*	*d*	*e*
A	38	12.7	27	25	30
E	39	12.7	27	27	32

a) In the case where the range of users' ages includes ages under 6



Unit : mm

Type of headform	*a*	*c*	*e*
A	38	27	49
E	39	27	52
J	41	27	54
M	41	27	55
O	42	27	56

b) In the case where the range of users' ages does not include ages under 6

Figure 1 Range of shock absorption test

b) Position the headform so that each striking point of the protective helmet comes to a point perpendicular above the centre of anvil, and the contact surface of the headform with the anvil at these striking points shall be horizontal.

In the case of using a monoaxial accelerometer, when the headform is placed at the striking points, the direction of the sensitivity axis of the accelerometer coincides with the plumb line within an angle of 5°.

7.3.3 Test procedure

The test shall be carried out as follows by using the apparatus specified in 7.3.5.

a) Drop the protective helmet on a flat steel anvil at a dropping velocity at impact of $5.42\ ^{0.1}_{0}$ m/s (corresponding to the drop height of 1.50 m), have an impact on two points from among four striking points selected according to 7.3.2, and measure the impact acceleration at the gravity centre of headform as a function of time.

b) Using a similar apparatus, drop the protective helmet on a hemispherical steel anvil at a dropping velocity at impact of $4.57\ ^{+0.1}_{0}$ m/s (corresponding to the drop height of 1.06 m), have an impact on the other two points from among four striking points selected in 7.3.2, which have had no impact by means of the flat steel anvil, and measure the impact acceleration at the gravity centre of the headform as a function of time.

7.3.4 Method for measurement

The method for measurement shall be as follows.

The dropping velocity of strikers is measured at an optional section between 1 cm and 6 cm from the striking point to an accuracy of 1 %. The acceleration at the gravity centre of the headform is measured and recorded by using the apparatus as specified in 7.3.5 e). However, a synthetic acceleration shall be measured for a triaxial accelerometer.

7.3.5 Test apparatus

The test apparatus shall be as follows.

a) Main test apparatus

1) An anvil firmly fixed on a platform

2) Either a free fall drop guiding device (for a triaxial accelerometer) or a wire-guided drop device (for a monoaxial accelerometer) (see figure 2)

3) A device for supporting a helmet-mounted headform

4) A headform equipped with triaxial or monoaxial accelerometer connected to the measuring device.

b) The platform shall be made of steel, concrete, or a mixture of these materials, and of at least 500 kg mass.

The platform shall be such that any visible deformation does not arise on the surface by the impact force of tests. The platform and anvil shall be free from resonance frequency that may affect the measurement.

c) Anvils shall be as follows.

1) A flat steel anvil shall be of circular form of 130 mm ± 3 mm diameter.

2) A hemispherical steel anvil shall be of 50 mm ± 2 mm radius.

d) Headform holdesr shall be as follows.

1) The holder for a headform shall not interfere measurement with an accelerometer that is carried out at the gravity centre of headform and be allowed to measure at any point across the test range.

2) The headform holder shall have the impact velocity that is not less than 95 % of theoretical impact velocity.

e) The accelerometer and the accelerometer connected to the measuring equipment shall endure an acceleration of 20 km/s^2 without damage, be of the mass not more than 50 g and have the following characteristics.

1) Frequency characteristic : at 10 Hz to 10 000 Hz, the permissible error is ± 1 dB.

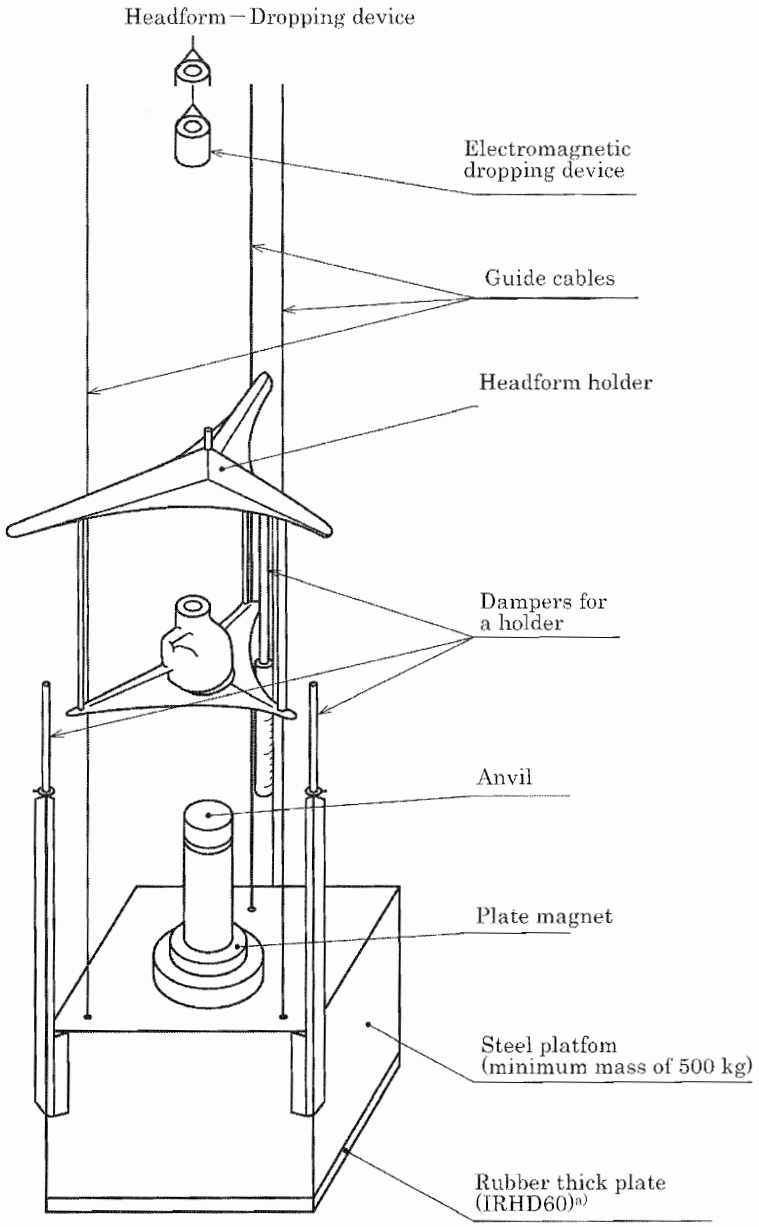
2) Maximum measuring value : 20 km/s^2 or over

3) Natural frequency : 20 000 Hz or over

4) The measurement recorder connected to the accelerometer shall have the following performances.

— Overall frequency characteristic of frequency class 1 000 specified in **JIS D 1050**. However, the frequency of 0 Hz to 20 Hz is not necessarily included.

— Capability for reading correctly the duration time of impact acceleration specified in **4.1** and for recording continuously the waveform of measurement record.

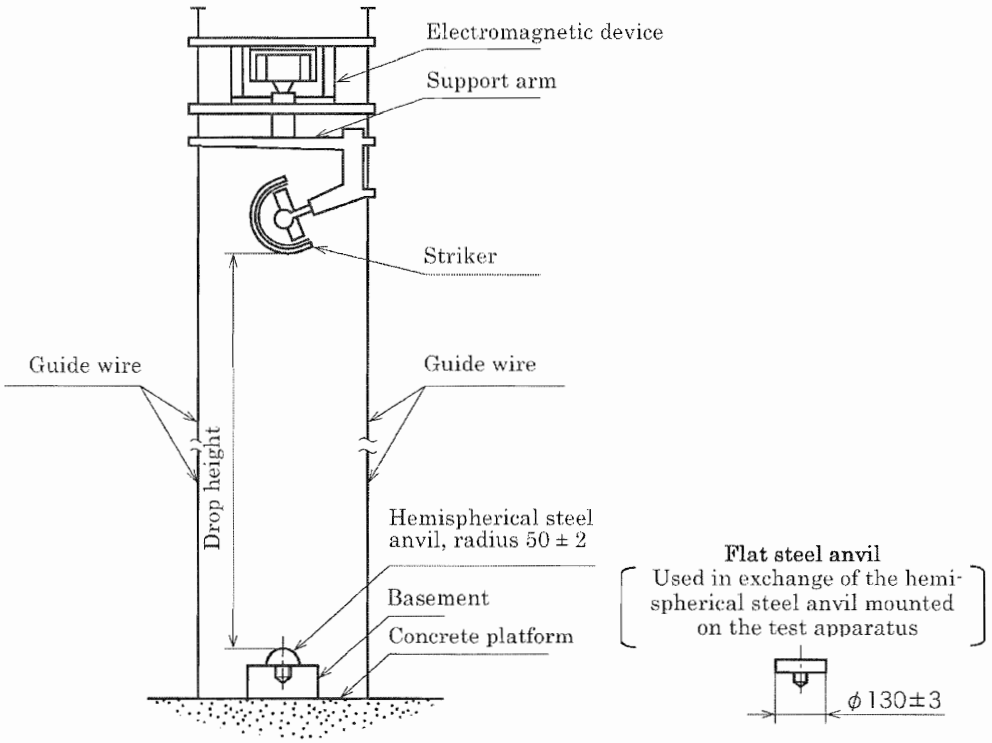


Note a) : In accordance with **JIS K 6253.**

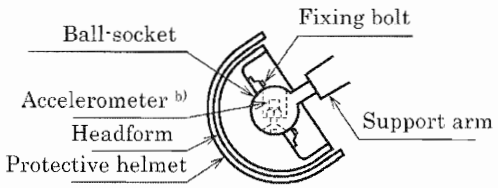
a) For triaxial accelerometer

Figure 2 Apparatus for shock absorption test (example)

Unit : mm



Striker for shock absorption test



Note b) : The accelerometer is mounted in the ball-socket inside the headform.

b) For monoaxial accelerometer

Figure 2 (concluded)

7.4 Strength test of supporting device

7.4.1 Test method

The test method for strength of the supporting device shall be as follows.

a) The strength test of the supporting device shall be carried out after the pre-conditioning specified in **7.2.1 a)** with using a headform with the same dimension as selected in **7.3.**

b) The protective helmet shall be mounted to the headform with adjusting the length of fastening device under "a chin strap hook" of a chin strap tester.

c) The test procedure shall be as follows.

1) Fasten the chin strap under the chin strap hook with holding the chin strap hook up so as to support the mass of anvil with the guiding rod and the falling weight on. At that time, the chin strap fastener shall not get in contact with the hook.

2) Adjust the roller centre of the chin strap hook so as to position at about 130 mm below the reference plane of headform, mount the loading device, and record the position of the falling weight placed on the anvil.

3) Pull up the falling weight and drop from a height of 600 mm ± 5 mm above the upper surface of anvil including the thickness of the foam pad, and then measure the maximum elongation of the supporting device. In addition, confirm whether the fastener can be easily released after dropping the weight.

In addition, the foam pad shall be made of expanded polyethylene with volume density of 40 kg/m^3 and have the similar diameter with that of the weight and 10 mm ± 1 mm thickness.

d) **Measurement** Maximum value of the dynamic elongation shall be measured.

7.4.2 Test apparatus

The test apparatus shall be as follows (see figure 3).

a) The chin strap hook with a centre-to-centre dimension of 76 mm ± 1 mm and diameter of 12.5 mm ± 0.5 mm, which is composed of two cylindrical rollers capable of rotating freely.

b) The guiding rod and parts mounted on the guiding rod, the total mass of which is 11 kg ± 0.5 kg including mass of falling weight of 4 kg ± 0.2 kg

c) The table equipped with the headform, which supports the protective helmet

d) The guiding rod with a dimension not less than the specified value (600 mm) of drop height of the falling weight

e) A displacement transducer capable of reading the amount of displacement

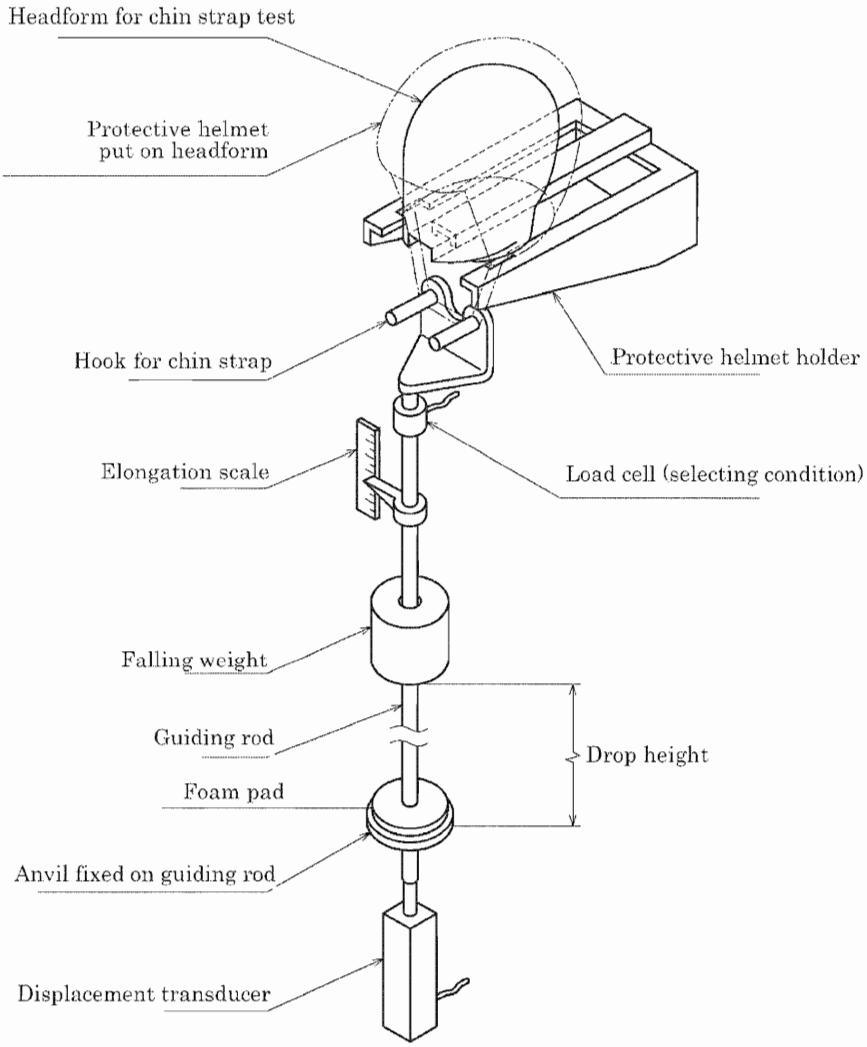


Figure 3 Apparatus for strength test of supporting devices (example)

7.5 Supporting capacity (roll off) test

7.5.1 Test method

The test method shall be as follows.

a) For the supporting capacity test, a headform with the same dimensions as selected in 7.3 shall be used. However, a size-adjustable protective helmet applicable to plural sized headforms shall be mounted on every sized headform, and tested after pre-conditioned as specified in 7.2.1 a).

b) Firmly mount the protective helmet to the headform as specified in Annex A.

c) Connect a stranded steel wire of the falling weight guiding device to the centre of the back of protective helmet and confirm no misalignment of a position where the protective helmet has been mounted.

d) Test the protective helmet by dropping the falling weight from a drop height of 175 mm ± 5 mm.

7.5.2 Test apparatus

The test apparatus shall be as follows (see figure 4).

a) Central distance between a relay reel and the headform shall be adjustable to 600 mm. In addition, the distance between the relay reel and the reference plane of the headform shall be adjustable to 600 mm.

b) The mass of falling weight shall be 10 kg ± 0.1 kg.

c) A total mass of the falling weight guiding device including the stranded steel wire shall be 3 kg ± 0.1 kg.

d) The drop height of falling weight guiding device shall be of a specified value (175 mm) or over.

e) The diameter of reel relaying the stranded steel wire shall be 100 mm ± 5 mm.

f) The diameter of stranded steel wire shall be 3 mm or over.

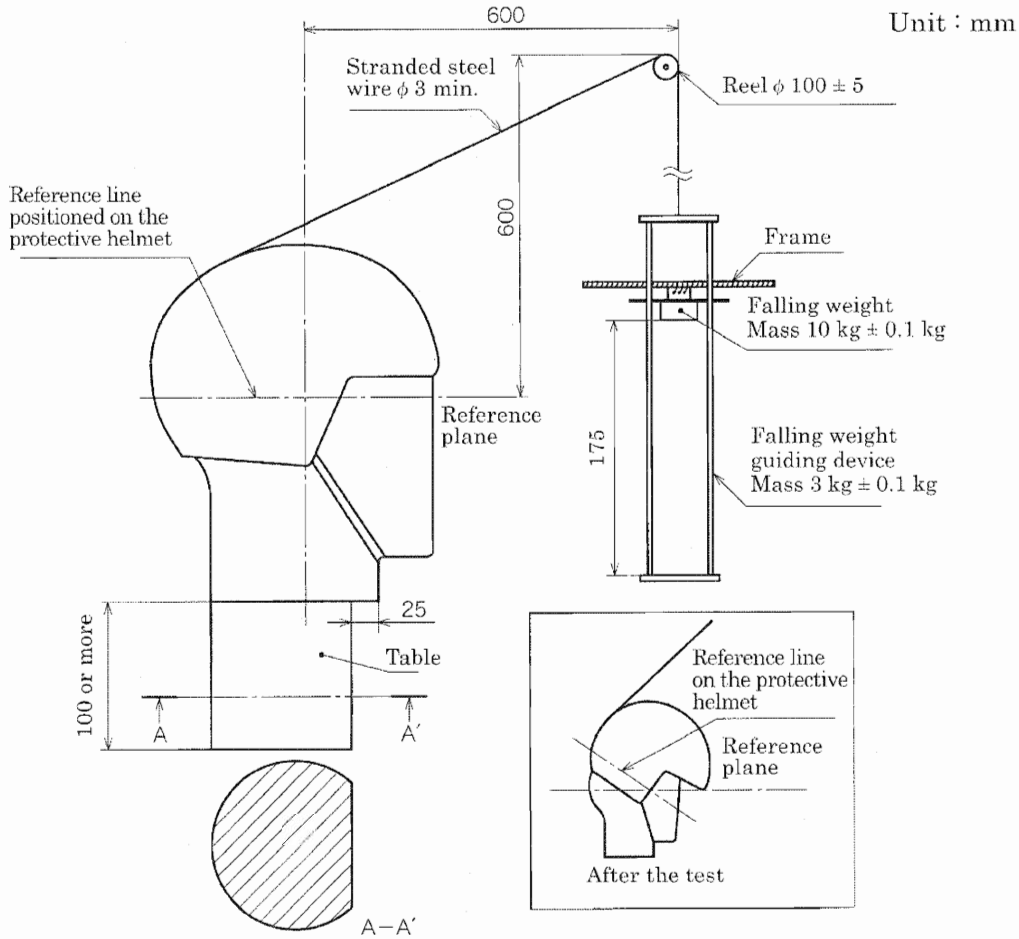
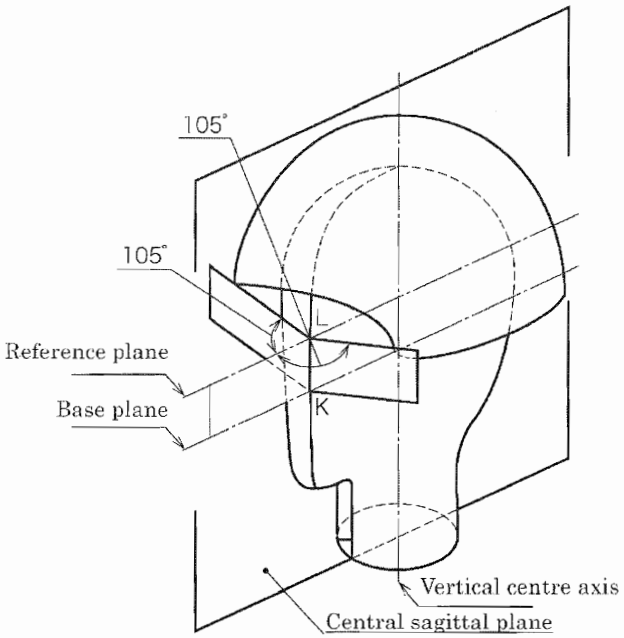


Figure 4 Apparatus for supporting capacity (roll off) test (example)

7.6 Measurement of visual field

Mount the protective helmet on the appropriate headform to the size of the protective helmet as specified in Annex A, and measure the visual field after confirming that there are no parts interrupting the visual field within the range as shown in figure 5. However, for a size-adjustable protective helmet applicable to plural sized headforms, measure the visual field with mounting it on every sized headform.



NOTE : Two V-shaped portions symmetrical to the central sagittal plane of headform, which are between the reference plane and the base plane. Each V-shaped portion shall be at an angle of not less than 105° with the central sagittal plane of the headform and defined by a vertical plane having a straight line LK as a ridge line.

Figure 5 Visual field—horizontal direction

8 Marking and information for user

8.1 Marking on the protective helmet

The protective helmet shall be marked indelibly with the following matters on the eas- ily visible place of the inner or outer surface of the protective helmet.

a) Standard number

b) Indication that it is the protective helmet for a bicycle user

c) "Usable age range" or "whether applicable or not for infants of ages under 6"

d) Name or trade mark of manufacturer or importer, etc.

e) Year and month of manufacturing or importing

f) Name of country where the protective helmet has been manufactured

g) For size of the protective helmet, the dimension of internal circumference of attaching device is indicated in centimetres.

In addition, the range is indicated for size-adjustable protective helmets.

h) Care to be taken

1) Wear the well-adapted protective helmet to a user's head.

2) Correctly fasten the chin strap.

3) Correctly wear the protective helmet on the head and never wear it at a slant.

4) Never use the protective helmet which has once received a big impact even without apparent damage.

8.2 Instruction manual

Instruction manual to be attached shall include the following matters.

In addition, they shall be clearly indicated with letters and figures with a readable size for general customers.

a) Read well the instruction manual and file it after reading. In addition, for the protective helmet for children or infants, guardians shall read and explain well the manuals.

b) Application (for example, protective helmet for bicycle users of "infants" or "school children", etc.)

c) Precautions for use

1) Wear the protective helmet of proper size for an age of users. Never use for riding on a moped or a motorcycle.

2) Wear the well-adapted protective helmet to a user's head.

3) Correctly fasten the chin strap.

4) Correctly wear the protective helmet on the head and never wear it at a slant.

5) Never use the protective helmet which has once received a big impact because its shock absorption has degraded even without apparent damage.

d) Describe the adjustment method for a size-adjustable protective helmet

e) A detergent, a disinfectant, a solvent, etc. to be used for maintenance of the protective helmet and the method

f) Name, address and phone number of the manufacturer, importer or distributor

Annex A (normative)
Method of mounting protective helmets on headforms

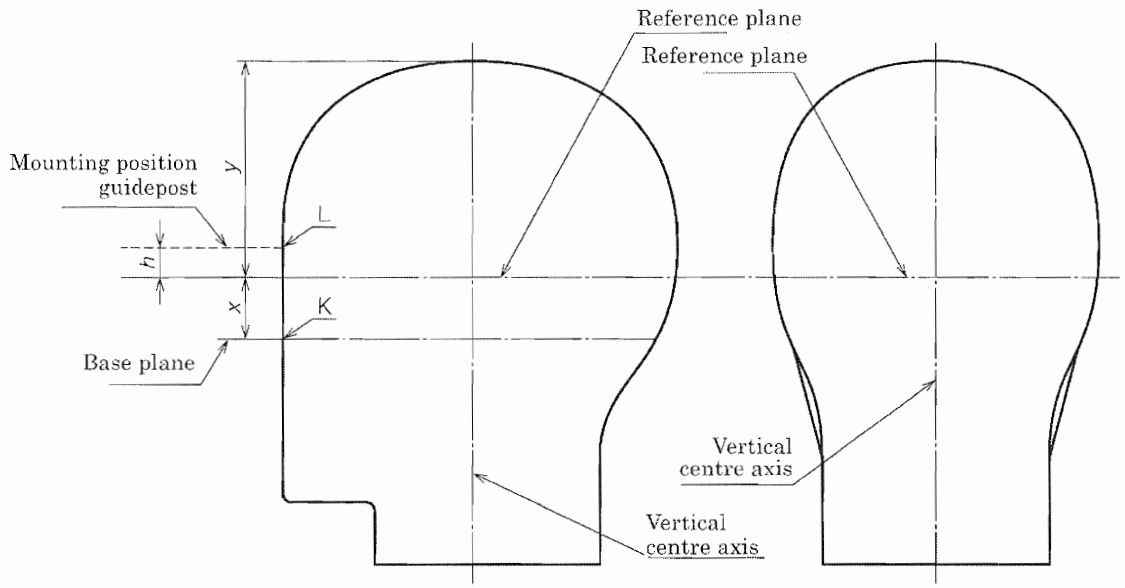
Introduction

This Annex specifies the method of mounting protective helmets on headforms.

A.1 Method of mounting the protective helmet on the headform

Mount the protective helmet on the headform selected according to table 1 with applying a load of 50 N ± 2 N as a standard in the vertical direction so that the front edge of the protective helmet coincides with the mounting position guidepost (h mm) (a height from the reference plane to the front edge of protective helmet) indicated by a manufacturer, etc., and fix with the supporting device.

In addition, when the mounting position guidepost is not indicated by a manufacturer, etc., mount the protective helmet so as to position the front edge of the protective helmet 12 mm above the reference plane and fix with the supporting device.



Unit : mm

Type of headform	x	y
A	24	90
E	26	96
J	27.5	102.5
M	29	107
O	30	110

Figure A.1 Headform

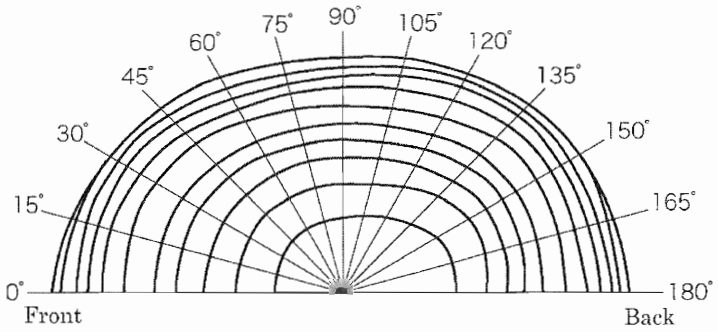
Annex B (normative)
Type of reference headforms (shape and dimensions of upper parts from reference planes)

Introduction

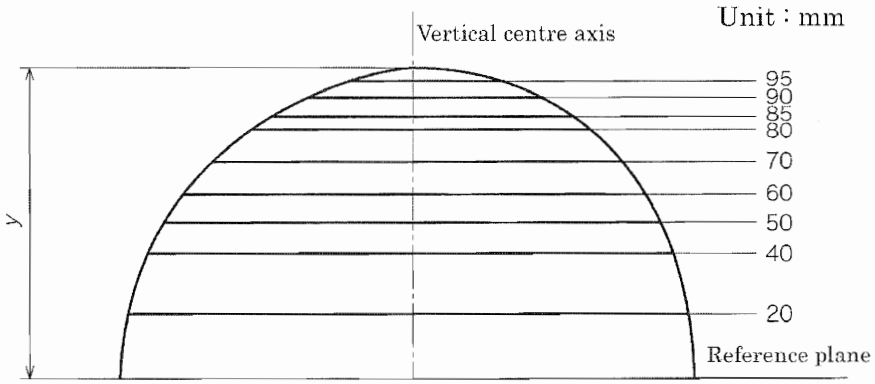
This Annex specifies the reference headform (shape and dimensions of the upper parts from the reference plane).

B.1 Shape and dimensions of upper parts from reference planes of reference headforms

The shape of the upper part from the reference plane of reference headform is shown in figure B.1, and the dimensions in tables B.1 to B.5.



a) Flat surface



b) Side surface

Figure B.1 Shape of upper parts from reference planes of reference headforms

Table B.1 Dimensions of upper parts from reference planes of reference headforms (Headform A)

Unit : mm

Headform A													
Height above the reference plane (y)	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Back
0	88.0	86.5	83.0	75.5	70.0	67.0	66.5	69.5	73.5	78.5	84.0	87.0	88.0
20	88.5	84.5	82.5	75.5	70.0	67.0	66.5	69.5	73.5	78.5	84.0	87.0	87.0
40	80.0	79.5	79.0	72.0	67.5	65.0	64.5	67.0	71.0	76.0	80.5	82.0	81.5
50	75.0	75.0	74.5	68.5	63.5	61.0	60.5	63.5	67.0	72.0	76.0	77.0	77.0
60	68.0	68.0	67.5	62.5	57.5	55.5	55.0	58.0	61.5	66.0	70.0	70.0	70.5
70	56.0	56.0	56.5	53.0	49.5	47.0	47.0	49.0	53.0	57.0	61.5	61.04	61.0
80	37.0	37.5	37.0	36.5	35.5	34.0	34.0	36.0	39.5	44.5	48.0	49.0	48.5
85	23.0	24.0	23.0	22.0	22.0	23.0	24.0	24.5	29.5	33.5	36.0	36.5	37.0
NOTE : Dimension y: 90 mm – Head circumference: 500 mm													

Table B.2 Dimensions of upper parts from reference planes of reference headforms (Headform E)

Unit : mm

Headform E													
Height above the reference plane (y)	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Back
0	94.5	93.0	90.0	82.0	76.5	73.5	73.0	76.0	80.0	85.0	91.0	94.0	94.5
20	92.5	91.5	89.0	82.0	76.5	73.5	73.0	76.0	80.0	85.0	90.5	93.5	94.0
40	87.0	87.5	85.0	79.5	74.5	71.0	71.5	74.0	77.5	82.5	88.0	89.0	89.0
50	82.5	83.0	81.0	76.0	71.0	68.0	68.0	70.5	74.0	79.5	83.5	84.5	84.5
60	6.5	76.5	75.5	71.0	66.5	63.5	63.5	66.0	69.5	74.0	78.5	79.0	79.0
70	66.5	66.5	66.5	63.0	59.0	56.5	56.5	58.5	62.0	66.5	70.5	71.0	71.0
80	52.0	52.0	52.0	50.0	47.5	46.0	46.5	48.0	51.0	56.0	59.5	60.0	60.0
85	41.5	41.5	41.5	40.5	39.5	39.0	39.5	41.0	44.0	48.0	51.5	52.0	52.0
90	28.0	28.0	28.5	28.5	28.5	29.0	30.0	31.0	34.0	37.5	41.5	42.0	42.0
95	10.0	10.0	10.0	10.0	10.0	10.5	11.0	12.0	13.5	15.0	16.0	16.0	16.0
NOTE : Dimension y: 96 mm – Head circumference: 540 mm													

Table B.3 Dimensions of upper parts from reference planes of reference headforms (Headform J)

Unit : mm

Headform J													
Height above the reference plane (y)	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Back
0	101.0	99.5	95.5	88.5	82.5	79.5	79.5	82.0	86.0	92.0	97.0	100.5	101.0
20	99.0	97.0	93.5	87.5	82.0	79.5	79.5	82.0	86.0	92.0	96.5	99.5	100.0
40	93.0	92.5	90.0	85.5	80.0	77.5	77.5	80.5	84.0	89.0	93.0	95.5	95.5
50	90.0	89.0	87.0	83.0	77.0	74.5	75.0	77.5	81.0	86.0	90.0	91.5	91.5
60	84.0	83.0	81.5	78.0	73.0	70.0	71.0	73.0	77.0	81.0	85.5	87.0	87.0
70	76.0	75.5	74.0	71.0	67.0	65.0	66.5	67.0	71.5	75.0	79.0	80.0	80.0
80	65.0	65.0	64.0	61.0	58.5	56.0	57.0	59.0	62.5	66.5	69.5	71.0	71.0
85	58.0	58.0	56.5	54.5	52.0	50.0	51.0	52.5	56.5	60.5	64.5	65.0	65.0
90	48.5	48.0	47.0	45.5	43.5	43.0	44.0	46.0	49.5	54.0	57.0	58.5	58.5
95	37.0	36.5	35.0	34.0	33.0	33.5	34.5	36.0	39.0	43.0	46.5	47.0	47.0
100	20.0	20.0	19.5	19.0	18.5	18.5	19.0	20.5	23.5	27.5	31.0	31.0	31.0
NOTE : Dimension y: 102.4 mm – Head circumference: 570 mm													

Table B.4 Dimensions of upper parts from reference planes of reference headforms (Headform M)

Unit : mm

Headform M													
Height above the reference plane (y)	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Back
0	106.0	104.0	101.0	93.5	87.0	84.5	84.0	86.5	91.0	96.0	102.0	106.0	106.0
20	103.5	102.5	99.5	93.0	87.0	84.5	84.0	86.5	91.0	96.0	101.5	105.5	105.5
40	99.0	98.5	96.5	90.5	85.0	82.5	82.0	84.0	88.5	93.5	97.0	100.5	100.5
50	95.5	94.5	93.0	87.5	82.0	79.5	79.0	81.5	85.5	91.0	94.0	97.0	97.0
60	89.5	89.5	88.0	83.0	77.5	75.0	75.0	77.0	81.5	86.5	90.0	92.0	92.0
70	82.0	82.0	81.0	77.0	72.0	69.5	69.5	71.5	75.5	81.0	84.0	85.5	85.5
80	71.5	71.5	71.0	68.0	64.0	61.5	61.5	64.0	67.0	72.0	76.0	77.0	77.0
85	64.5	64.5	64.0	61.5	59.0	57.0	57.0	58.5	61.5	66.5	71.0	72.0	72.0
90	56.5	56.5	56.5	55.0	53.0	51.5	51.5	53.0	56.0	60.5	64.5	66.0	66.0
95	46.5	46.5	46.5	46.5	45.5	44.0	44.0	45.5	48.5	53.0	57.5	58.0	58.5
100	32.0	32.0	32.0	33.0	34.0	34.0	34.5	35.5	38.5	43.0	46.5	47.0	48.0
105	12.0	12.0	12.0	14.0	16.0	16.0	17.5	19.5	21.0	25.0	29.5	30.0	30.0
NOTE : Dimension y: 107.2 mm − Head circumference: 600 mm													

Table B.5 Dimensions of upper parts from reference planes of reference headforms (Headform O)

Unit : mm

Headform O													
Height above the reference plane (y)	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Back
0	108.5	107.5	103.5	96.0	90.5	87.5	87.0	90.0	94.5	100.0	105.0	108.0	108.5
20	106.5	105.5	103.0	96.0	90.5	87.5	87.0	90.0	94.5	100.0	105.0	108.0	107.5
40	101.5	101.5	100.5	93.5	88.5	85.5	85.5	88.5	92.5	98.0	103.0	103.0	103.5
50	98.0	97.5	97.0	90.5	85.5	82.5	83.0	85.5	90.0	95.0	100.0	100.0	100.5
60	93.0	93.0	92.0	86.5	81.0	78.5	78.5	81.5	85.5	90.5	95.0	95.0	95.5
70	86.5	86.5	86.0	80.5	75.0	73.5	73.5	76.0	80.0	85.0	89.0	89.0	89.0
80	76.0	76.5	76.5	72.5	67.0	66.0	66.5	69.0	72.5	77.0	81.0	80.5	80.5
85	69.5	69.5	70.0	67.5	62.5	61.5	62.0	64.5	67.5	72.5	76.0	76.0	76.0
90	62.5	62.5	62.5	60.0	57.0	55.5	56.5	58.5	62.0	67.0	70.0	70.0	70.0
95	54.0	54.0	54.0	52.5	50.0	49.0	49.5	51.5	55.5	60.5	64.0	64.0	64.0
100	42.0	41.5	41.5	41.0	41.0	41.5	41.5	43.5	47.0	52.0	55.5	55.5	55.5
105	27.5	27.0	27.0	27.0	27.5	27.5	27.5	29.0	31.5	36.0	37.5	38.0	38.5
NOTE : Dimension y: 110.2 mm − Head circumference: 620 mm													

Annex C (normative)

Type of reference headforms (shape and dimensions of lower parts from reference planes)

Introduction

This Annex specifies the reference headform (shape and dimensions of the lower part from the reference plane).

C.1 Shape and dimensions of lower parts from reference planes of reference headforms

The shape of the lower part from the reference plane of reference headform is shown in figure C.1 and the dimensions in tables C.1 to C.5.

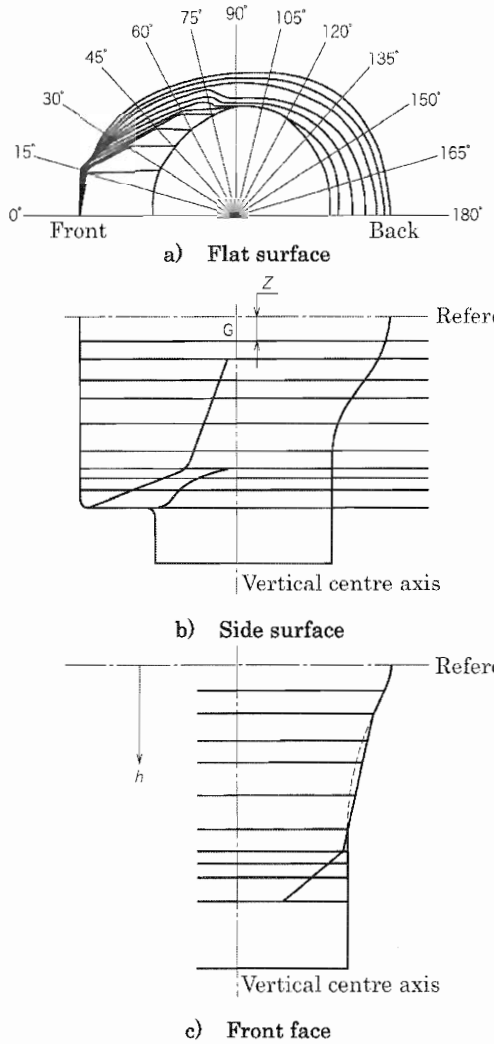


Figure C.1 Shape of lower parts from reference planes of reference headforms

Table C.1 Dimensions of lower parts from reference planes of reference headforms (Headform A)

Unit : mm

Headform A													
Height above the reference plane (h)	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Back
0	88.0	86.5	83.0	75.5	70.0	67.0	66.5	69.5	73.5	78.5	84.0	87.0	88.0
− 11.1	88.0	86.5	82.5	74.5	68.5	66.0	66.0	68.5	72.0	77.0	81.5	84.5	85.0
− 19.9	88.0	88.0	82.5	74.0	66.5	63.0	61.5	64.5	67.5	72.5	77.0	80.0	80.5
− 30.6	88.0	89.5	81.0	71.5	65.0	62.0	56.0	58.0	61.5	66.5	71.0	73.5	84.0
− 39.4	88.0	89.5	79.0	69.0	63.0	60.0	54.0	55.0	58.0	61.5	65.0	67.5	67.0
− 52.5	88.0	89.5	77.0	67.0	60.5	54.0	51.5	52.0	53.5	56.5	59.0	60.0	58.5
− 65.6	88.0	89.5	75.5	65.0	58.5	52.5	50.5	51.0	51.5	52.5	53.0	54.0	54.5
− 74.4	88.0	89.5	73.5	62.5	58.0	51.0	50.5	51.0	51.5	52.5	53.0	54.0	54.5
− 78.8	88.0	9.5	71.5	60.5	49.5	50.0	50.5	51.0	51.5	52.5	53.0	54.0	54.5
− 84.4	88.0	89.5	69.5	47.5	49.5	50.0	50.5	51.0	51.5	52.5	53.0	54.0	54.5
− 92.8	88.0	92.0	47.5	47.5	49.5	50.0	50.5	51.0	51.5	52.5	53.0	54.0	54.5
− 19.0	47.0	47.0	47.5	47.5	49.5	50.0	50.5	51.0	51.5	52.5	53.0	54.0	54.5
NOTE : Dimension Z: 11.1 mm − Head circumference: 500 mm													

Table C.2 Dimensions of lower parts from reference planes of reference headforms (Headform E)

Unit : mm

Headform E													
Height above the reference plane (h)	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Back
0	94.5	93.0	90.0	82.0	76.5	73.5	73.0	76.0	80.0	85.0	91.0	94.0	94.5
− 11.9	94.5	93.0	88.5	79.5	73.0	70.5	70.5	73.0	77.0	82.5	87.0	90.5	91.0
− 21.3	94.5	94.0	88.5	79.0	71.0	67.5	66.0	69.0	72.0	77.5	82.5	85.5	86.0
− 32.8	94.5	95.5	86.5	76.5	69.5	66.5	60.0	62.5	66.0	71.0	76.0	78.5	79.0
− 42.1	94.5	95.5	84.5	74.0	67.5	64.0	57.5	59.0	62.0	66.0	70.0	72.0	71.5
− 56.2	94.5	95.5	82.5	71.5	64.5	57.5	55.5	55.5	57.0	60.5	63.0	64.0	63.0
− 70.2	94.5	95.5	80.5	69.5	62.5	56.0	54.0	55.0	55.5	56.0	56.5	57.5	58.0
− 79.6	94.5	95.5	78.5	67.0	62.0	54.5	54.0	55.0	55.5	56.0	56.5	57.5	58.0
− 84.3	94.5	95.5	76.5	64.5	53.0	53.5	54.0	55.0	55.5	56.0	56.5	57.5	58.0
− 90.4	94.5	95.5	74.5	51.0	53.0	53.5	54.0	55.0	55.5	56.0	56.5	57.5	58.0
− 99.3	94.5	98.5	50.5	51.0	53.0	53.5	54.0	55.0	55.5	56.0	56.5	57.5	58.0
− 127.4	50.0	50.0	50.5	51.0	53.0	53.5	54.0	55.0	55.5	56.0	56.5	57.5	58.0
NOTE : Dimension Z: 11.9 mm − Head circumference: 540 mm													

Table C.3 Dimensions of lower parts from reference planes of reference headforms (Headform J)

Unit : mm

Headform J													
Height above the reference plane (h)	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Back
0	101.0	99.5	95.5	88.5	82.5	79.5	79.5	82.0	86.0	92.0	97.0	100.5	101.0
− 12.7	101.0	99.5	94.5	85.0	78.0	75.5	75.5	78.0	82.0	88.0	93.0	96.5	97.0
− 22.7	101.0	100.5	94.5	84.5	76.0	72.0	70.5	73.5	77.0	83.0	88.0	91.5	92.0
− 35.0	101.0	102.0	92.5	81.5	74.0	71.0	64.0	66.5	70.5	76.0	81.0	84.0	84.5
− 45.0	101.0	102.0	90.0	79.0	72.0	68.5	61.5	63.0	66.0	70.5	74.5	77.0	76.5
− 60.0	101.0	102.0	88.0	76.5	69.0	61.5	59.0	59.5	61.0	64.5	67.5	68.5	67.0
− 75.0	101.0	102.0	86.0	74.0	67.0	60.0	57.5	58.5	59.0	60.0	60.5	61.5	62.0
− 85.0	101.0	102.0	84.0	71.5	66.0	58.0	57.5	58.5	59.0	60.0	60.5	61.5	62.0
− 90.0	101.0	102.0	81.5	69.0	56.5	57.0	57.5	58.5	59.0	60.0	60.5	61.5	62.0
− 96.5	101.0	102.0	79.5	54.5	56.5	57.0	57.5	58.5	59.0	60.0	60.5	61.5	62.0
− 106.0	101.0	105.0	54.0	54.5	56.5	57.0	57.5	58.5	59.0	60.0	60.5	61.5	62.0
− 136.0	53.5	53.5	54.0	54.5	56.5	57.0	57.5	58.5	59.0	60.0	60.5	61.5	62.0
NOTE : Dimension Z: 12.7 mm − Circumference of head: 570 mm													

Table C.4 Dimensions of lower parts from reference planes of reference headforms (Headform M)

Unit : mm

Headform M													
Height above the reference plane (h)	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Back
0	106.0	104.0	101.0	93.5	87.0	84.5	84.0	86.5	91.0	96.0	102.0	106.0	106.0
− 13.3	106.0	104.0	98.5	88.5	81.5	79.0	79.0	81.5	85.5	92.0	97.0	100.5	101.5
− 23.7	106.0	105.0	98.5	88.0	79.5	75.0	73.5	76.5	80.5	86.5	92.0	95.5	96.0
− 36.5	106.0	106.5	96.5	85.0	77.5	74.0	67.0	69.5	73.5	79.5	84.5	87.5	88.0
− 47.0	106.0	106.5	94.0	82.5	75.0	71.5	64.0	66.0	69.0	73.5	78.0	80.5	80.0
− 62.6	106.0	106.5	92.0	80.0	72.0	64.0	61.5	62.0	63.5	67.5	70.5	71.5	70.0
− 78.3	106.0	106.5	90.0	77.0	70.0	62.5	60.0	61.0	61.5	62.5	63.0	64.0	64.5
− 88.7	106.0	106.5	87.5	74.5	69.0	60.5	60.0	61.0	61.5	62.5	63.0	64.0	64.5
− 94.0	106.0	106.5	85.0	72.0	59.0	59.5	60.0	61.0	61.5	62.5	63.0	64.0	64.5
− 100.7	106.0	106.5	83.0	57.0	59.0	59.5	60.0	61.0	61.5	62.5	63.0	64.0	64.5
− 110.7	106.0	109.5	56.5	57.0	59.0	59.5	60.0	61.0	61.5	62.5	63.0	64.0	64.5
− 142.0	56.0	56.0	56.5	57.0	59.0	59.5	60.0	61.0	61.5	62.5	63.0	64.0	64.5
NOTE : Dimension Z: 13.3 mm − Head circumference: 600 mm													

Table C.5 Dimensions of lower parts from reference planes of reference headforms (Headform O)

Unit : mm

Headform O													
Height above the reference plane (h)	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Back
0	108.5	107.5	103.5	96.0	90.5	87.0	87.0	90.0	94.5	100.0	105.0	108.0	108.5
− 13.7	108.5	107.5	101.5	91.5	84.0	81.0	81.0	84.0	88.0	94.5	100.0	108.5	104.5
− 24.4	108.5	108.0	101.5	91.0	81.5	77.5	76.0	79.0	83.0	89.0	94.5	98.5	99.0
− 37.6	108.5	109.5	99.5	87.5	79.5	76.5	69.0	71.5	76.0	81.5	87.0	90.5	91.0
− 48.4	108.5	109.5	97.0	85.0	77.5	73.5	66.0	67.5	71.0	76.0	80.0	83.5	82.0
− 64.5	108.5	109.5	94.5	82.0	74.0	66.0	63.5	64.0	65.5	69.5	72.5	73.5	72.0
− 80.6	108.5	109.5	92.5	79.5	72.0	64.5	62.0	63.0	63.5	64.5	65.0	66.0	66.5
− 91.4	108.5	109.5	90.5	77.0	71.0	62.0	62.0	63.0	63.5	64.5	65.0	66.0	66.5
− 103.8	108.5	109.5	85.5	58.5	60.5	61.0	62.0	63.0	63.5	64.5	65.0	66.0	66.5
− 114.0	108.5	113.0	58.0	58.5	60.5	61.0	62.0	63.0	63.5	64.5	65.0	66.0	66.5
− 146.2	57.5	57.5	58.0	58.5	60.5	61.0	62.0	63.0	63.5	64.5	65.0	66.0	66.5
NOTE : Dimension Z: 13.7 mm − Head circumference: 620 mm													

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